Remarks

Claims 1-27 and 33-37 remain in the application.

The Examiner has imposed a restriction requirement between the inventions of:

I. Claims 1-18, method of joining two silicon parts, classified as 156/329;

II. Claims 19-27, joined silicon assembly, classified as 428/119; and

III. Claims 28-32, adhesive, classified as 428/208.2.

The restriction requirement between Groups I and II is traversed. The classification of Group II is incorrect since class 428/119 is a subclass of 428/98 (structurally defined web or sheet). Silicon is not mentioned. The claimed invention does not recite a web or sheet. Groups I and II are best classified together. Claims 28-32 have been canceled.

The Examiner suggests an amendment to the specification on page 2. The suggestion has been followed. The Examiner also recommends some amendments for the FOx trademark. Amendments to pages 8 and 9 of the specification are believed to relieve the Examiner's concerns.

The Examiner rejects claims 1-17 under 35 U.S.C. 103(a) as being obvious over Sadatoshi et al. (JP 55-163702, hereafter Sadatoshi) in view of Carlson et al. (U.S. Patent 4,541,035, hereafter Carlson). Note that Sadatoshi is believed to be a given name while Nakazono is family name. Nonetheless, the Examiner's naming will be followed. A professional translation of the Sadatoshi reference is enclosed together with a certificate of translation. Applicants do not have a copy of the abstract referenced by the Examiner. The translation will be referenced rather than the abstract because the reference as a whole must be considered. This rejection is traversed.

Sadatoshi discloses a method of welding together two ceramic members including temporarily adhering them together with a paste including (1) either a refractory metal silicide or a mixture of a refractory powder and a silicon powder and (2) an organic binder. (Bottom paragraph on page 3). The organic binders include poly(vinyl alcohol), methyl cellulose, and starch. (Top paragraph on page 4). Clay or SiO_2 may be added as long as it does not affect

conductivity. (Last sentence on page 3). During the welding at 1300° to 1700°C, the organic binder is decomposed. (Fourth paragraph on page 4). As a result, Sadatohsi's organic binder does not read upon the silica bridging agent of claim 1, which the annealing converts into a silica network. Instead, Sadatoshi's welding (annealing) is expected to decompose the organic binder. No silicon or silica component is mentioned for Sadatoshi's organic binder. Sadatoshi's optional silica is neither a bridging agent nor is it disclosed to form a silica network.

The principal function of Sadatoshi's organic binder is to provide "temporary adhesion of the members" (second and third paragraphs on page 4) during the welding. As a result, Sadatoshi advantageously would not apply his paste to the joining areas but would join his members outside of the paste, which is to disappear during welding.

Sadatoshi does not define his ceramic members to be joined. In EXAMPLE 1, Sadatoshi describes his paste 2 being used to join a SiC heater element 3 to two SiC terminals. Silicon is not mentioned either as a possible ceramic material for use with Sadatoshi's invention nor is silicon known to be used as a heater element.

The Examiner's use of Carlson is not clear. Carlson discloses a multi-level printed circuit board based upon a monocrystalline silicon substrate 14. At least one intermediate wiring level 22a is sandwiched between two insulating silicon oxide layers 16a, 25a. A silicon integrated circuit 12 is epoxied to the top insulating layer 25a. Clearly, the insulating silicon oxide layer 25a does not qualify as one of the two silicon parts of claim 1. Perhaps, the Examiner is suggesting bonding Carlson's integrated circuit 12 directly to the silicon substrate 14. No such structure is suggested and such a structure, in any case, is disadvantageous. The silicon substrate 14 has a resistivity of 100 to 1000 ohm-cm. While this is fairly resistive for silicon, it is still sufficiently conductive to effectively short out the entire silicon wafer 12 to which it is bonded. There is no suggestion, as required by the law of obviousness, to replace Carlson's much more resistive insulating layer 25a with the less resistive silicon substrate 14 as the layer to which his integrated circuit 12 is bonded. Yet further, such a structure does not provide the multi-level board strongly and exclusively taught by Carlson.

Yet further, Sadatoshi's method requires welding the two silicon parts together by passing sufficient current between the two bonded silicon part to heat the part to above 1300°C. First,

passing this amount of current through an already fabricated integrated circuit is highly unusual and no art has been cited for the possibility. Secondly and more importantly, heating a completed integrated circuit including metallization levels to above 1300°C is highly deleterious and is likely to destroy the chip. Such temperatures will melt the commonly used metalllizations of aluminum and copper. That is, not only is the combination of Sadatoshi and Carlson unobvious, the combination offers no apparent advantage but only disadvantages and failure.

Accordingly, the rejection of claim 1 and its dependent claims should be withdrawn.

The Examiner states that the annealing temperature in claim 3 of between 900° and 1100°C would depend upon the bonding mixture used. However, Sadatoshi is welding together his two ceramic members. Welding depends upon the melting temperatures of the two members, not of the temporary adhesive. The melting point of the claimed silicon parts is known to be above 1400°C, a temperature far above the range recited in claim 3.

The Examiner dismisses the restriction of the silicon powder in claims 6 and 11 to be virgin poly or CVD poly. No art has been cited for the existence of virgin poly powder nor for the use of virgin or CVD poly in adhesives. Lacking some suggestion in the art, these claims must be held additionally allowable.

The Examiner dismisses the restriction of claims 12-14 for the bridging agent to be either a silicone-containing material or a spin-on glass. The use of spin-on glasses in silicon semiconductor devices teaches nothing about their use in adhesives and is totally unlike the paste of Satadoshi.

The Examiner also dismisses the restriction of claim 15 for the very small sized silicon powder in the 100nm range. In contrast, Sadatoshi mentions silicon powder sizes in the tens of microns. Absent a showing of why Sadatoshi's teachings are advantageously extended to significantly smaller silicon powder, this claim and claims 9 and 10 must be held additionally allowable.

The Examiner has rejected claims 1-18 under 35 U.S.C. 103(a) as being obvious Sadatoshi in view of Boyle et al. (U.S. Patent 6,455,395, hereafter Boyle). This rejection is traversed.

Even accepting *arguendo* that Sadatoshi's method is obviously applied to silicon parts, it

is unobvious to apply the method to Boyle's silicon towers in a way that conforms to the claims. As a preliminary matter, the Examiner states that Sadatoshi teaches using the his paste mixture in a variety of environments, including the semiconductor art. Applicants' attorney cannot find a passage in Sadatoshi for such a teaching. Further, the word "semiconductor" cannot be found. Sadatoshi discloses using his invention for heater elements or igniters. (Fifth paragraph on page 4). Such devices are electrical but are not typically described as semiconductors.

It is unlikely though conceivable in hindsight to attempt to apply Sadatoshi's welding methodto form a silicon tower including the use of silicon powder and an organic binder. However, as argued above, Sadatoshi fails to disclose a silica bridging agent or a silica network. Further, Sadatoshi's welding method in which both parts across the junction are heated to above their melting points seems totally inappropriate for a bulk tower having large joining areas. Yet further, if Sadatoshi's method were to be applied to Boyle's tower, Sadatoshi would apply his paste outside of the seam, most probably after initial assembly, since it would disappear after welding. In contrast, claim 1 requires the paste to be applied to at least one of the joining surfaces.

The skilled mechanic in comparing Sadatoshi and Boyle would likely conclude that Sadatoshi's welding method is vastly inferior to Boyle SOG adhesive in bonding together Boyle's silicon tower. Further, there is no suggestion for the advantages of using Sadatoshi's welding method in conjunction with Boyle's SOG adhesive. Boyle's parts may be loosely aligned with mortise holes and the like and an external jig can provide any further required alignment, as described in the reference Boyle application on SOG. It is not seen how a hardened paste would be effective for Boyle's large tower rather than Sadatoshi's tiny heater element. There is simply no need for Sadatoshi's temporary adhesive in addition to Boyle's permanent SOG adhesive and no advantages have been presented for substituting it for Boyle's SOG adhesive.

The Examiner has not suggested that Sadatoshi's silicon powder be placed in Boyle's SOG but the combination will be addressed. Sadatoshi fails to disclose the technical function for his additional silicon powder beyond its use with the refractory powder and organic binder in producing better ultimate joints. There is no suggestion or even suspicion found in the applied

art that silicon powder can be advantageously combined with the substantially different adhesive represented by Boyle's spin-on glass.

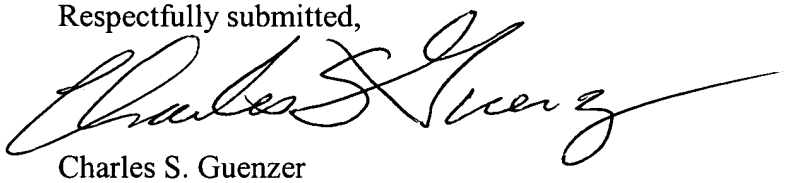
A new dependent claim 33 requires that the silica matrix join the two silicon parts after the annealing. In contrast, Sadatoshi's paste is disclosed to decompose and essentially disappear after the welding (annealing).

A new set of claims 34-37 have been added using an alternative claiming approach. The generalization to a broad class of glasses is supported at page 13, lines 15-19 of the filed application.

In view of the above amendments and remarks, reconsideration and allowance of all claims are respectfully requested. If the Examiner believes that a telephone interview would be helpful, he is invited to contact the undersigned attorney at the listed telephone number, which is on California time.

Date: 19 Sept. 2005

Respectfully submitted,



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